Gold

Atomic number 79
Atomic weight 196.97

Collection

Serum/Plasma	2 mL	Plastic tube No anticoagulant
Urine	20 mL	Sterile Universal

Reference ranges

			Reference
Serum/plasma	µmol/L	2.54-10.15	1,2
Blood			
Urine	µmol/L	1.52-10.15	1,2
	µmol/L	<LOQ	3

Notes

Typical values seen during monthly maintenance chrysotherapy. Levels up to 15.3 µmol/L may be obtained with more frequent treatment

References

1 Billings R, Grahame R, Marks V, Wood P and Taylor A. Blood and urine gold levels during chrysotherapy for rheumatoid arthritis. Rheumatology and Rehabilitation 1975; 14: 13-18

2 Griffin AJ, Huston G and Taylor A. Maintenance chrysotherapy in rheumatoid arthritis-A comparison of 2 dose schedules. Annals of the Rheumatic Diseases 1981; 40: 250-253

3 Morton J, Leese E, Tan E, Cocker J. Determination of 61 elements in urine samples collected from a non-occupationally exposed UK adult population, Toxicol. Letters 2014; 231: 179-193.

Clinical

The attractive appearance and relative immutability of gold has resulted in a long history of economic, decorative and artistic use. Over many centuries the element was used to treat many medical conditions. More recently, gold compounds were found to have an anti-bacterial activity e.g. in the treatment of tuberculosis and syphilis. The element has become prominent in the treatment of rheumatoid arthritis, where gold compounds are among the disease modifying anti-rheumatic drugs. Currently the most popular are aurothiomalate administered by intramuscular injection and auranofin which is given orally. While many patients derive relief from aurotherapy there are a number of side effects. Most are transitory and are either self-limiting or resolve when treatment is suspended but serious toxicity affecting the bone marrow occurs in a small number of patients. Gold has also been used for a number of other conditions with a possible auto immune basis, such as psoriatic arthritis, juvenile chronic polyarthritis (Stills disease) and pemphigus. Some suggest that gold drugs merely inhibit the function of the various components of the immune response associated with rheumatoid arthritis, rather than acting in a disease curing fashion. However it is more widely thought that gold affects the entire immune response, phagocytes, leukocytes, T-Cells etc to reduce its potency and limit its oxidizing nature, to end the cycle of joint inflammation and erosion. As newer anti-rheumatic drugs have become available the popularity of aurotherapy has declined. While it is not considered in the NICE recommendations it is included in the Scottish Intercollegiate Guidelines Network on the

management of early rheumatoid arthritis.

A number of clinical applications of gold nanoparticles have been described. Destruction of tumour cells has been demonstrated when particles are irradiated with near infrared light. Heat is emitted which will specifically and non-invasively destroy cells. Human breast carcinoma cells grown in culture were killed to a depth of about 6 mm. Nanoparticles can also be used for drug delivery to tumours and for *in vivo* imaging.

Toxicity

A range of side effects occurs with gold therapy from the relatively trivial to the severe. Early signs may be the development of pruritis or dermatitis which will respond to the withdrawal of the gold. Treatment can often be reintroduced without further problems. More severe consequences include proteinuria which may develop into nephrotic syndrome. Progression of the renal lesion is generally avoided by the withdrawal of the therapy. The most serious side effect of gold therapy is bone marrow dysplasia. Other less common side effects include cholestatic jaundice , colitis and a diffuse interstitial lung disease. Common side effects of oral gold include diarrhoea, decreased appetite, nausea and hair thinning Gold-induced proteinuria and thrombocytopaenia occur more frequently in patients with RA who possess HLA-DR3; this antigen is found in most reported patients with gold-induced thrombocytopenia. The HLA-DQA region genes may also be important in patients with RA; one study, for example, demonstrated that they confer susceptibility for gold nephropathy

Laboratory Investigations

The peak plasma gold concentration is reached some six hours following injection of aurothiomalate; but the concentration reached is extremely variable between individuals. The half -life in plasma is approximately 5 days and if weekly injections are given, the concentration will gradually rise. Most of the gold in blood is confined to the plasma where the majority is bound to albumin. It has been argued that the binding is not tight, as measurable amounts of gold are found in the urine during chrysotherapy. Urinary gold excretion follows a similar pattern to that of the plasma gold concentration. Some 60% of gold that is injected is retained. Although toxicity associated with gold therapy may be related to gold accumulation in the tissues, there is no apparent relationship between serum or urinary gold concentrations and the onset of toxicity. Therefore regular measurement of plasma gold in patients on gold therapy is not recommended, but the assay has some value in the assessment of patients being treated for toxicity by chelation therapy.

Regular tests to check for proteinuria and for thrombocytopaenia are required.

References

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